Global Hydrology Resource Center

Data User Guide

SeaFlux Data Products

Introduction

The SeaFlux Data Products dataset consists of estimates of ocean surface latent and sensible heat fluxes, 2m and 10m wind speed, 2m and 10m air temperature, 2m and 10m air humidity, and skin sea surface temperature. This data product was created by using the SeaFlux V3 model. These data are available globally from January 1, 1988 through December 31, 2018 in netCDF-4 format.

Citation

Roberts, Jason B., C. A. Clayson, and F. R. Robertson. 2020. SeaFlux Data Products [indicate subset used]. Dataset available online from the NASA Global Hydrology Resource Center DAAC, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/SEAFLUX/DATA101

Keywords:

NASA, GHRC, SeaFlux, global, model, ocean surface turbulent fluxes, sea surface temperature

Product Description

There are multiple ongoing efforts to develop satellite-based estimates of the ocean surface turbulent fluxes and associated near-surface properties. These efforts principally rely on the application of microwave imager observations capable of providing information on near-surface wind speeds, humidity, and to a lesser extent temperature. The SeaFlux-Climate Data Record (Clayson and Brown, 2016; hereafter referred to as SearFluxCDR) was recently produced and provided the first 3-hourly varying ocean climate data record of air-sea fluxes. It relied on the use of SSM/I and SSMIS passive microwave imager observations to retrieve near-surface winds, humidity, and temperature with a neural network following Roberts et al. (2010). Diurnally varying sea surface temperature (SST) were provided by superimposing a diurnal cycle onto the foundation SST provided by the NOAA Optimally Interpolated Sea Surface Temperature (Reynolds et al. 2007). Despite the use of intercalibrated brightness temperatures, subsequent analyses revealed inconsistencies in the SeaFluxCDR parameters between sensors, especially in latitudes poleward of 40°. Multiple improvements have been undertaken to the SeaFluxCDR that have resulted in a

new dataset, SeaFluxV3. More information about these improvements can be found in the *Algorithm* section of this user guide.

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Data Characteristics

The SeaFlux Data Products data are available in netCDF-4 format at a Level 4 data processing level. More information about the NASA data processing levels are available on the EOSDIS Data Processing Levels webpage. The characteristics of this dataset are listed in Table 1 below.

Table 1: Data Characteristics

Characteristic	Description
Model	SeaFlux
Spatial Coverage	N: 85.549, S: -85.549, E: 179.870, W: -179.870 (Global)
Spatial Resolution	0.25 degrees
Temporal Coverage	January 1, 1988 - December 31, 2018
Temporal Resolution	Hourly, Daily, and Monthly
Sampling Frequency	1 hour
Parameter	Latent heat flux, specific humidity of air, sensible heat flux, sea surface temperature, air temperature, and wind speed
Version	1
Processing Level	4

File Naming Convention

The SeaFlux Data Product files are available in netDF-4 format. The data files are named using the following convention:

Data files: SeaFluxV3_[Daily|Hourly|Monthly]_[YYYYMM|YYYYMMDD|YYYYMMDDhh].nc4

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
.nc4	netCDF-4 format

Data Format and Parameters

The SeaFlux Data Products data file is in netCDF-4 format. There are 21 fields in the data file including latent heat flux, specific humidity, sensible heat flux, sea surface temperature, and wind speed.

Table 3: Data fields in the SeaFlux netCDF-4 data file

Variable	Description	Unit
lat	Latitude	Degrees North
lhf	Latent Heat Flux. Positive upward (out of ocean)	W/m^2
lhf_error	Latent heat flux random uncertainty	W/m^2
lon	Longitude	Degrees East
obsflag*	Flag for land/ice/observed/unsampled: 0 = Land 1 = Ice 2 = Unsampled 3 = Observed	-
qair_10m	Specific humidity of air at 10m	g/kg
qair_2m	Specific humidity of air at 2m	g/kg
qair_error	Specific humidity analyzed total error	g/kg
shf	Sensible Heat Flux. Positive upward (out of ocean)	W/m^2
shf_error	Sensible heat flux random uncertainty	W/m^2
sst	Skin sea surface temperature at 1m	Degrees C
tair_10m	Air temperature at 10m	Degrees C
tair_2m	Air temperature at 2m	Degrees C
tair_error	Air temperature analyzed total error	Degrees C
tau_error	Wind stress magnitude random uncertainty	N/m^2
taux	Zonal wind stress, positive eastward	N/m^2
tauy	Meridional wind stress, positive northward	N/m^2
time	time	Seconds since 1970-01-01
wspd_10m	Wind speed at 10m	m/s
wspd_error	Wind speed analyzed random error	m/s
wspdn_10m	Equivalent neutral wind speed at 10m	m/s

*Those pixels which are unsampled and/or observed both represent the final value of the analysis after running the Kalman filter. An identification of "observed" indicated that an actual observation was available at that location and time. Note that technically a Kalman smoother has been used so that neighboring observations in time (i.e. before and after) can impact the analysis for hours which were not sampled (i.e. "Unsampled").

Algorithm

Retrievals have been developed using the latest Global Precipitation Measurement mission Level 1C intercalibrated brightness temperature record (Berg et al., 2018). The nonlinear neural-network based retrievals of wind speed, air temperature, and air specific humidity (Roberts et al., 2010) were updated to include a priori information on water vapor and atmospheric temperature structure using MERRA-2, a long-term record of global atmospheric analyses, beginning in 1980, to address regional biases found in Roberts et al. (2019). The collection of microwave imagers has extended beyond SSM/I and SSMIS to include TMI, AMSR-E, AMSR-2, and GMI. Each sensor was further adjusted to account for earth incidence angle variability. Near-surface retrievals from each sensor were further intercalibrated using a quantile-matching approach using collocated estimates; the intercalibration was chained backwards in time using GMI as the primary reference. Diurnally varying sea surface temperatures generated for the SeaFlux-CDR record were applied to the OISST for all surface flux computations using the COARE-3.5 (Edson et al., 2013) algorithm. The new approach is developed to generate hourly estimates of near-surface parameters — SST, 2m air temperature, 2m humidity, and 10m wind speed on a global, 25km equal area scalable earth (EASE) grid. To address data gaps, a Kalman Filter has been developed to generate a gap-free analysis over the ice-free ocean. The satellite observations, properly weighted for their uncertainties are blended with model information from MERRA-2.

The near-surface wind speed, humidity, and temperature were estimated using a variant of the Roberts et al. (2010) retrieval approach but tuned for application to the more recently available sensors. After the official campaign, lessons learned from this effort together with those from the previous development of the SeaFluxCDR were taken into account in the development of SeaFluxV3.

More information on the algorithm used to create this data product can be found at Edson, 2015 and COARE-Met Flux Algorithm.

Quality Assessment

A Kalman smoother has been used so that neighboring observations in time (i.e. before and after).

Software

No software is required to view the netCDF-4 data file; however, Panoply can be used to easily view this file.

Known Issues or Missing Data

Since Kalman smoother was used on the data, it can impact the analysis for hours which were not sampled (i.e. 'Unsampled' in the *obsflag* variable).

References

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Related Data

All other dataset using the SeaFlux model are considered related and can be located by searching the term "SeaFlux" in the GHRC HyDRO2.0 search tool. Listed below are datasets from other field campaigns and studies that used the same model:

GPM Ground Validation SEA FLUX ICE POP
(http://dx.doi.org/10.5067/GPMGV/ICEPOP/SEAFLUX/DATA101)

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To order these data or for further information, please contact:

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Created: 10/22/2020